(12) UK Patent Application (19) GB (11) 2 279 637 (13) A

(43) Date of A Publication 11.01.1995

(21) Application No 9412934.3

(22) Date of Filing 28.06.1994

(30) Priority Data
(31) TO93A0481 (32) 01.07.1993 (33) IT

(71) Applicant(s)
Cavanna SPA

(Incorporated in Italy)

Via Matteotti 104, 28077 Prato Sesia (Novara), Italy

(72) Inventor(s)
Duilio Pavese
Renzo Francioni

(74) Agent and/or Address for Service
Page White & Farrer
54 Doughty Street, LONDON, WC1N 2LS,
United Kingdom

(51) INT CL^6
B65B 51/30 9/00

(52) UK CL (Edition N)
B8C CU32 CW17 C40A4
B5K K3A3

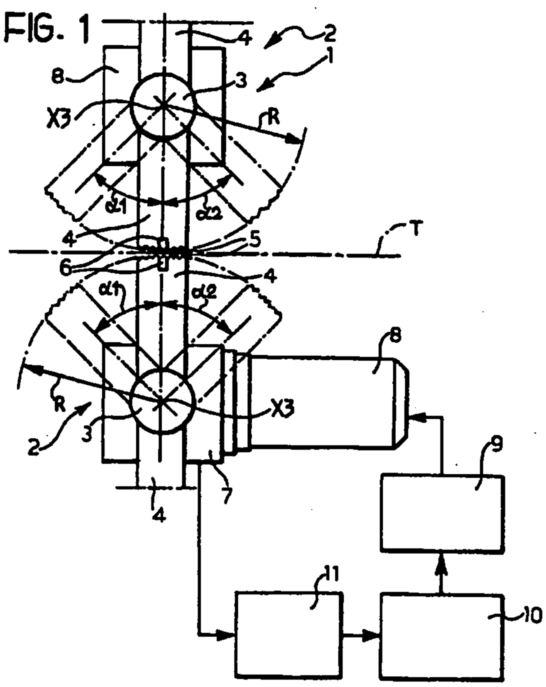
(56) Documents Cited
GB 2214128 A GB 2179888 A GB 1332242 A

(58) Field of Search
UK CL (Edition M) B5K, B8C CU32 CW17
INT CL^5 B65B 9/00 9/06 51/26 51/30
ONLINE DATABASES: WPI

(54) Control of rotary jaw of packaging machine

(57) A rotary jaw closure unit (2) has one or more active elements (4). During an interval ($-\alpha1$; $\alpha2$) in which the active elements (4) of the rotary jaws (2) interact with a wrapping for products being wrapped to press it, weld it, and, possibly, cut it, the orbital speed of the jaws (2) is regulated to have a constant velocity. Jaw speed decreases linearly before the constant velocity interval and increases linearly afterwards. Electronic controller (10) receives a signal from an encoder (11) indicative of the rotary position of the jaws, and controls jaw motor (8) via control card (9).

FIG. 1



GB 2 279 637 A

FIG. 1

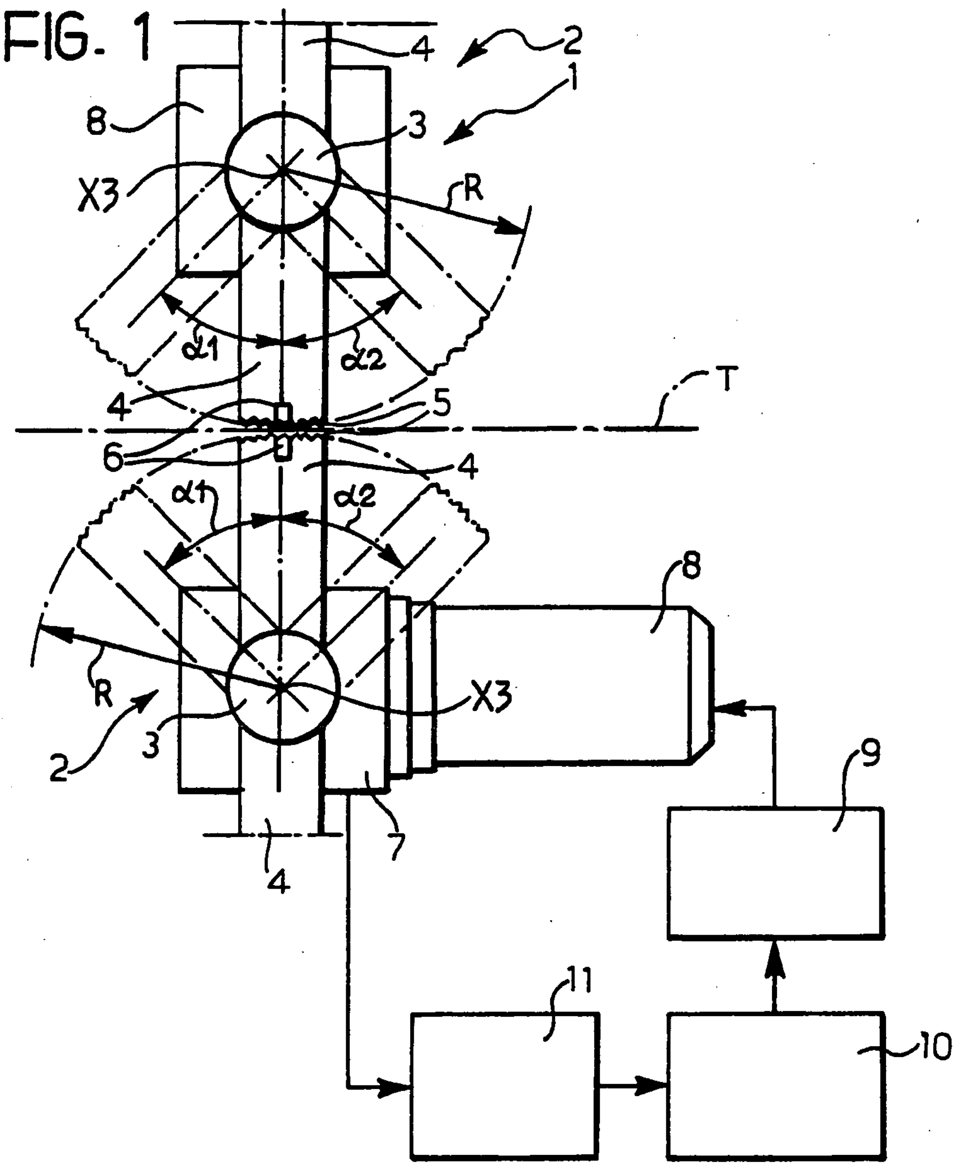

4
2
1
8
3
X3
R
α1
α2
T
4
5
6
4
α1
α2
8
R
X3
3
2
9
7
4
11
10

FIG. 2

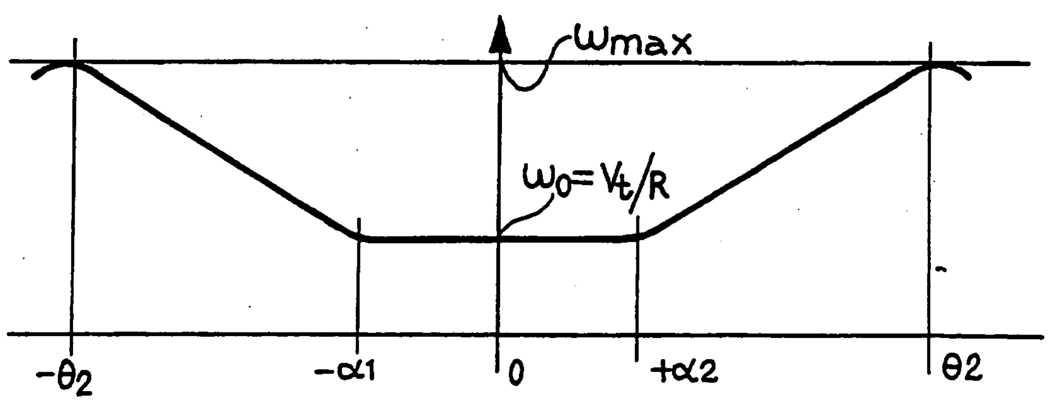
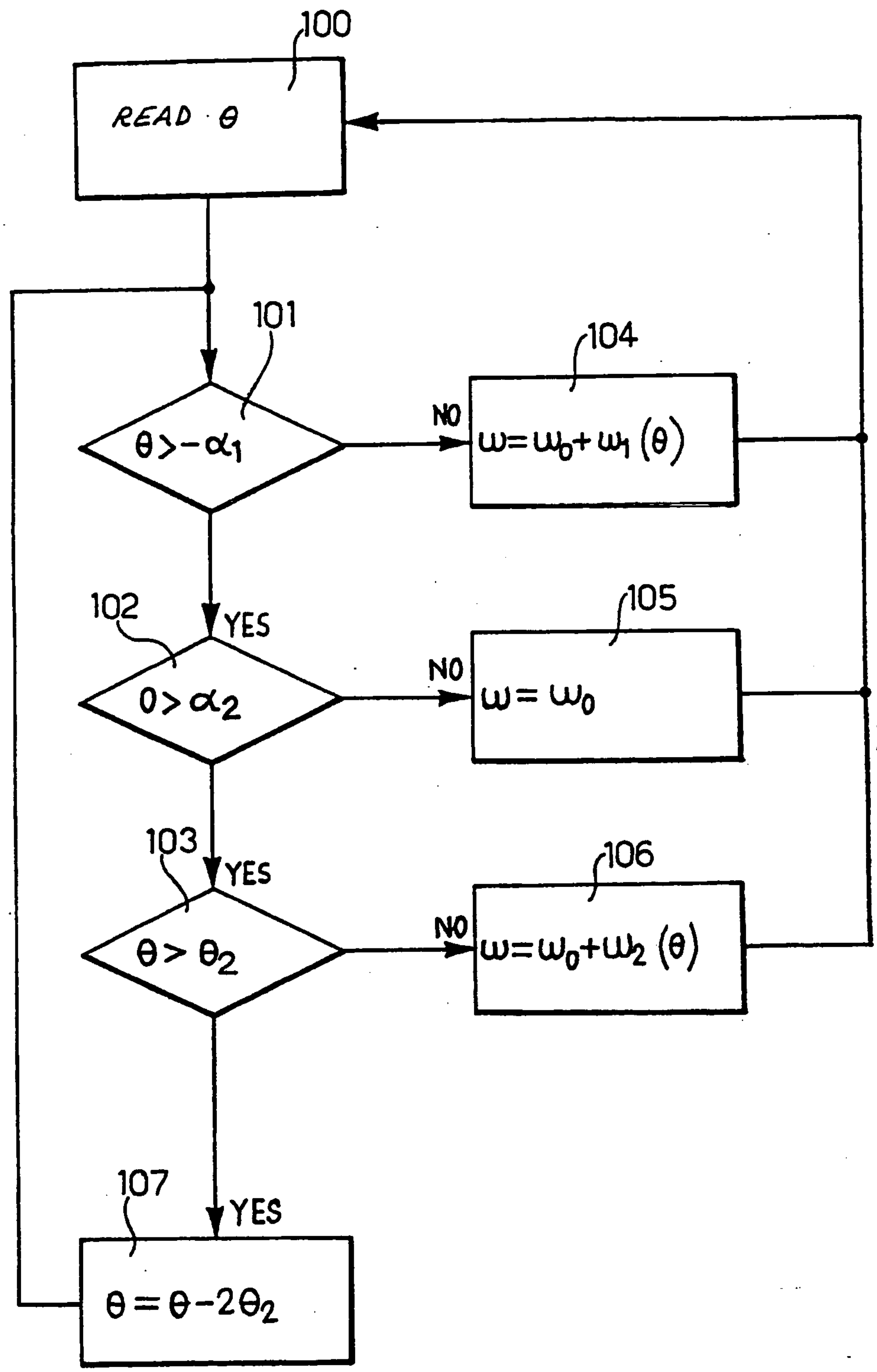

ωmax
ω0=Vt/R
-θ2
-α1
0
+α2
θ2

FIG. 3


100
READ θ
101
θ>−α1
104
NO
ω=ω0+ω1 (θ)
102
YES
0>α2
105
NO
ω=ω0
103
YES
θ>θ2
106
NO
ω=ω0+ω2 (θ)
107
YES
θ=θ−2θ2

2279637

A method of controlling the operation of a rotary jaw closure unit for a packaging machine.

The present invention relates to a method of controlling the operation of a rotary jaw closure unit for a packaging machine, and to a packaging machine comprising a rotary jaw closure unit.

Closure units of the above-specified type are currently used in the art as described, for example, in United States patents US-A-4 862 673, US-A-4 914 889 or US-A-4 955 184 all assigned to the same Assignee as the present application.

In more recent configurations the closure unit includes two superimposed rotary jaws together defining a space or gap through which passes a tubular wrapping within which articles or groups of articles to be packaged are disposed with a uniform spacing.

Each jaw usually comprises a driven shaft on which are mounted one or more active elements which, by the effect of the rotation of the shaft about its axis, describe an orbital, typically circular, movement about this axis.

The synchronised movement of the jaws results in an active element of the jaw mounted in an upper position being lowered whilst an active element of the lower jaw

is raised so that the two elements in question press the wrapping between them and thus close it to form a transverse sealed zone (usually by heat welding of the material comprising the wrapping). This sealed zone is then cut to separate off the wrapping thus formed, either by the jaws which have formed the closure of the wrapping or, in other configurations, by a further counter-rotating jaw unit situated downstream.

Equally known and utilised in the art is the fact that the movement of the jaws is not controlled with a uniform angular velocity, but rather by imparting to the jaws a generally "swinging" movement which can be generally expressed according to a relation of the type:

$$\omega(\theta) = \omega_0 + \omega_p(\theta)$$

where $\omega_p(\theta)$ expresses a pendulum function generally, in which the angular velocity $\omega(\theta)$ of the jaws assumes a minimum value in the region ($\theta \cong 0$) where the jaws interact with the wrapping.

To achieve the said pendulum function use is usually made of epicyclic mechanisms or the like: with regard to which US patent US-A-4 914 889 cited above can be usefully consulted.

Use of such mechanisms always results in a certain operational compromise. The pendulum function referred

to above means that as it approaches the region of interaction with the wrapping, the jaw slows its orbital movement to reach a minimum velocity value (so as to be able, so to say, to "accompany" the wrapping) when the active element which acts at this time on the wrapping is exactly aligned in a vertical direction with the active element of the complementary jaw, and then accelerates after the pressing, welding and possibly cutting of the wrapping has been effected, when the active elements of the jaws are spaced from the wrapping and disengaged from it.

The above is strictly true for wrapping machines of the traditional mechanical type; in which the movements of the various active units of the wrapping machine are driven from a single main motor via transmission and biasing mechanisms.

However, even in more recent wrapping machines of the so called "electronic" type, in which the various active units (which comprise the closure unit) are actuated by respective motor units (such as electronically controlled electric motors) the said intervention mechanism has been retained almost unchanged.

In either case this arrangement cannot be considered to be optimal. It does not in fact allow all the stresses (especially those in the direction of longitudinal

traction) deriving from the interaction between the jaws and the wrapping to be eliminated.

The present invention seeks to provide a method of controlling a closure unit of the above-specified type, in which the said disadvantages are radically eliminated.

According to a first aspect of the invention, there is provided a method as claimed in the appended claim 1.

According to a second aspect of the invention, there is provided a packaging machine as claimed in the appended claim 9.

The invention will now be described, purely by way of non-limitative example, with reference to the attached drawings in which:

Figure 1 generally illustrates in schematic form the structure of a closure unit which can be operated using the method of the invention;

Figure 2 is a timing diagram which illustrates the speed of rotation of the jaws in a unit operating according to the invention; and

Figure 3 illustrates, in the form of a flow diagram, the possible modes of operation of a control method according to the invention.

In Figure 1 the reference numeral 1 generally indicates a rotary jaw closure unit of the type currently utilised in continuous movement horizontal wrapping machines of

the type currently called "flow pack" or "form-fill-seal" (or "FFS" for short).

In substance the unit 1 comprises two superimposed rotary jaws 2 intended to act on a tubular wrapping W containing within it regularly spaced articles or groups of articles A to be wrapped. The wrapping W advances between the two jaws 2 in a horizontal direction along a line indicated T and from left to right in Figure 1 at a velocity Vt which is normally constant.

Each jaw 2 is constituted by a shaft 3 with a horizontal axis X3 on which one or more active elements 4 (two, angularly spaced by a 180° in the embodiment illustrated) constituting the jaws themselves are mounted and provided with end surfaces 5 situated at a distance R from respective axes of rotation X3. In use, because the shafts 3 rotate (in opposite directions for example anti clockwise and clockwise respectively for the two jaws 2 visible in Figure 1) active elements 4 act on the wrapping W with the ends 5 to achieve pressing of wrapping W, welding of the portions brought into contact so as to form a junction zone and, possibly, cutting of this junction zone so as to obtain separation of the separate wrappings thus formed.

Welding of the wrapping is usually achieved by heat welding of the material constituting the wrapping W

itself: for this purpose, on the end surfaces 5 of the active elements 4 are disposed heating elements, usually of electrical thermo-resistive type (not illustrated), intended to cause local heat fusion of the material of the wrapping W upon contact therewith.

As far as the cutting of the welding regions is concerned, this can be achieved simultaneously with the welding, by means of cutters 6 provided on the end surfaces 5, or else by a similar structural unit situated downstream (also not illustrated).

As already mentioned in the introductory part of the present description, the general criteria and details of construction of the closure unit of the type specified are widely known in the art and do not therefore require to be described in detail herein.

In particular, it is known to link the rotary movements of the two shafts 3 together in such away as to obtain an exact coordination of the movement of the active elements 4.

As already mentioned, the result which it is desired to obtain is that of ensuring that whilst an active element 4 of the upper jaw (that situated above line T) is lowered towards the wrapping W, advancing with it, an active element 4 of the lower jaw (that is that situated

below the line T) rises, also following the wrapping completely symmetrically with the active element of the upper jaw.

In this way, with reference to the position illustrated in solid outline in Figure 1, when the active element 4 of the upper jaw 2 is orientated vertically and therefore orthogonally of the path T of the wrapping W, the corresponding lower element 4 is also located in an angularly identical position beneath the line T.

This result, and synchronisation of the movements of the two shafts 3 can be obtained, for example, as illustrated in the arrangement referred to in Figure 1 of the attached drawings, by linking the shaft 3 of one of the jaws (for example the lower jaw) with a geared motor 7 driving by an electric motor 8 and transmitting the movement to the shaft 3 of the upper jaw via a mechanical transmission constituted, for example, by two bevel gears with the output wheel of the first bevel gear (the input wheel of which is driven by the geared motor 7) drawing the input wheel of the said second bevel gear via a transmission shaft. The said mechanical transmission is not explicitly illustrated in the attached drawings.

Naturally, it is also possible to consider doubling up the motorisation of the two jaws (lower and upper) by associating with each of these a respective electric

motor which drives the shaft about which the respective active elements move and by synchronising the movement of the two motors in an arrangement of the type known as "electric shaft".

As is known, the adoption of two rotary jaws which are not exactly mutually simmetrical is not essential. In particular, there are known in the art (see for example US patent US-A-4 862 673) closure units in which the upper jaw has a different number of active elements from the number of active elements of the lower jaw (for example two active elements on the upper jaw and three active elements on the lower jaw).

Naturally, in this case, synchronisation of the movement of the two shafts 3 must take place in such a way as to take account of the different number of active elements.

The same considerations hold true in the case in which, for specific operating reasons, it is desired to utilise two jaws in which the radii of the orbital trajectories described by the ends 5 of the active elements 4 are different from one another (in this regard again see US patent US-A-4 862 673, in which there is also described the possibility of conferring on the closure unit assembly 1 a general to and fro pendulum movement).

Whatever the constructional details of the unit 1, it

will be sufficient for the purpose of understanding the invention to recall the fact that, in general, the speed of movement of the motor 8 (or motors if separate motors are used for the two jaws) is regulated, taking account of the number of active elements on each jaw, the radius of the respective orbital trajectory etc, in such a way as to achieve synchronisation of the approaching movement (closure) and separation movement (opening) of the two active elements (one on the upper jaw, the other on the lower jaw) with respect to the wrapping which advances along the path T to be pressed, welded and, possibly, cut.

To this end the jaws drive unit 2 (hereinafter in the present description reference will, for simplicity, be made to a single motor such as the motor 8 Figure 1) is controlled via a respective control card 9 (such cards are normally provided on electric motors adopted for wrapping machines for the more recent generations) provided for electronic control, starting from a programmable unit 10 (typically a programmable logic control or "PLC"). This by further providing a position sensor 11 (typically a so-called encoder, preferably of optical type) associated with the output shaft of the motor 8 or, in general, with one of the movable members of the unit 1 so as to provide the programming unit 10 with a signal indicative of the angular position of the active elements 4 of the jaws of

the unit 1.

With specific reference for example to the embodiment illustrated in Figure 1, hereinafter in the present description it is supposed that the two jaws 2 both have two active elements 4, mounted diametrically opposite one another (and therefore angularly spaced by 180°) and having the same orbital trajectory as the active ends 5 with a radius R about the respective axis of rotation X3 of the shafts 3.

It is further supposed that, in dependence on the dimensions of the articles A to be wrapped and of the wrappings which it is desired to obtain (and assuming that the angular position of the two elements 4 is defined by a general angle θ, with θ=0 when each element is orientated vertically), the active elements 4 come into contact with the wrapping W which advances in a horizontal direction (trajectory T) when they form an angle $\alpha 1$ with respect to the vertical and then separate from the pressed, welded, and, possibly, cut wrapping after having travelled through angle $\alpha 2$ from the direction of vertical alignment.

The said angles are in general referred to the median plane of the active elements, which usually have a symmetrical shape. In any case, even if active elements 4 of non-symmetrical profile are used, the said angles $\alpha 1$

and $\alpha 2$ are in any event definable as angular positions of rotation of the respective shaft 3. In the great majority of situations of normal use it can further be assumed that the two angles $\alpha 1$ and $\alpha 2$ are the same as one another (interval $\alpha 1$; $\alpha 2$ symmetrical with respect to the condition $\theta=0$: element 4 orthogonal with respect to the wrapping W).

The method of the invention is essentially based on the recognition of the fact that, in wrapping of the so called electronic type (and in general in all situations in which it is possible selectively and independently to control the drive of the rotary jaw closure unit) it is possible to achieve (for example by electronic control of the card 9 by the controller 10 according to a general feedback arrangement starting from the angular position signal provided by the encoder 11), a point-by-point adjustment of the speed of rotation of the unit, in particular the speed of rotation of the shafts 3 and therefore of the instantaneous speed at which the active elements 4, and in particular the peripheral ends 5 thereof, describe their orbital movement.

In particular, the present invention is based on the recognition of the fact that such a control configuration of the drive lends itself easily to achieve a regulation of the orbital movement of the active elements so that, over the whole of the timing interval and distance for

which the ends 5 of the active elements 4 remain in contact with the wrapping T, these ends move with constant velocity equal to the speed of advance Vt of the wrapping along the direction T.

It is therefore possible to achieve the condition that, for the whole of the interval ($-\alpha 2$; $+\alpha 1$) for which the active elements 4 act on the wrapping T, these active elements exactly follow the wrapping itself without speed variations.

In particular, the electronic control of the speed of rotation of the motors 8 makes it possible to obtain the following result

$$\omega(\theta) = \omega_0 = Vt/R \text{ for } -\alpha 2 < \theta < \alpha 1 \qquad (1)$$

where $\omega(\theta)$ represents the angular velocity of the shafts 3 and R is the radius of the orbital trajectory described by the ends 5 of the active elements 4.

The achievement of the condition that the jaws 2 follow of the wrapping exactly and precisely has advantages from several points of view.

In the first place, above all during the initial phase of the interaction between the jaws and the wrapping, it is possible to avoid any phenomenon of relative slippage.

Especially if the welding of the wrapping to be closed is achieved by heat welding this permits optimisation of the transfer of heat from the jaws to the wrapping which is to be heat welded.

Secondly, when, by the effect of heat welding of the wrapping, the ends 5 of the jaws establish a certain adhesive connection with the material of the wrapping T which deforms under the effect of the heat welding (and by the effect of any surface shaping such as grooves, etc, with the ends 5 of the active elements 4 of the jaws are normally provided) the exact synchronisation of the speeds prevents the application of longitudinal stresses to the wrapping T by the jaws. These longitudinal stresses can cause damage to the wrapping, in particular in the region of the welding just formed, or, in extreme cases can also cause tearing of the wrapping itself.

The arrangement according to the invention, however, provides a great improvement over arrangements known in the art, whether mechanical or otherwise, in that, whilst a pendulum action of the speed of rotation is provided within the range of the contact interval with the wrapping W, with the intention of making the advancing movement of the active elements 4 as close as possible to the speed of advancement of the wrapping, the effective speed of advance is identical only in a very narrow time range : typically only in correspondence with

the position of vertical alignment ($\theta = 0$) of the two jaws.

The diagram of Figure 2 schematically illustrates a speed control law relating the speed of rotation of the rotary jaw unit which can be performed according to the invention.

In particular, the diagram of Figure 2 illustrates the variation of the velocity $\omega(\theta)$ imparted to the shafts 3 by the motor 8 as a function of the angle which describes the angle of inclination of the active elements 4 with respect to the plane of vertical alignment of the two axes X3.

As can be seen, the interval ($-\alpha1$; $\alpha2$) during which the velocity of rotation is maintained at the constant value ω_0 is defined by the relation (1) shown hereinabove.

Outside this interval (which corresponds to the interval during which the active elements 4 are in contact with the wrapping T) the speed of rotation of the jaws varies.

In particular, whilst approaching the wrapping ($\theta < \alpha2$), the speed of rotation is caused gradually to fall starting from a maximum value ωmax towards the value ω_0 according to a relationship of the type

$$\omega(\theta) = \omega_0 + \omega 1(\theta + \alpha 1)$$

where the function $\omega 1(\theta + \alpha 1)$ is a decreasing function substantially similar to a rectilinear ramp with end connection zones ($\sin^2$ function or similar).

Similarly, after the active elements 4 have left the wrapping ($\theta > + \alpha 2$) the speed of rotation $\omega(\theta)$ is gradually brought back up from the value $\omega 0$ to the value ωmax according to a function of the type

$$\omega(\theta) = \omega_0 + \omega_2\ (\theta - \alpha 2)$$

where $\omega_2\ (\theta - \alpha 2)$ is a rectilinear acceleration ramp (here too with a connection region at the ends according to a $\sin^2$ function for example), which carries the speed $\omega(\theta)$ back towards the value ωmax.

This latter value is reached at the angular value $\theta 2$, which also expresses the period of the diagram of Figure 2.

The value of $\theta 2$ is equal to 180° in the case of rotary jaw units having a single active element 4. In this case, between two successive operations of the element 4 on the wrapping, the shaft 3 on which the active element is mounted must perform an angle of rotation equal to 360° (2 x $\theta 2$ with $\theta 2$ = 180°).

In the exemplary embodiment illustrated here, in which on each shaft 3 there are mounted two active elements 4, $\theta 2$ is equal to 90° for the presence of two active elements. In this case between two successive operations on the wrapping the shaft 3 must rotate through an angle equal to 180°, that is $2 \times \theta_2$ with $\theta 2 = 90°$.

In a similar manner, if the jaws were to comprise three active elements (with an operation on the wrapping every 120° of rotation of the shaft) $\theta 2$ would be equal to 60°.

Naturally, if the two jaws were to have radii of rotation R of the active elements different from one another, the relations expressed by formula 1 and by Figure 2 will be derived independently for each jaw.

In general, $\omega 1(\theta) = \omega 2(-\theta)$, that is to say the deceleration ramp and the acceleration ramp are usually controlled in a symmetrical manner.

The diagram of Figure 3 illustrates, in the form of a flow diagram, the possible implementation of a control programme controlling the motor card 9 by the controller 10 according to the previously described criteria.

At predetermined intervals the controller 10 reads (phase 100) the signal provided by the encoder 11 indicative of the current position (angle θ) of the active elements 4:

for conceptual simplicity it is supposed here that the rotary jaws are identical to one another.

Subsequently (comparisons in phases 101, 102, 103) the controller 10 compares the signal indicative of the position of the active element with the three threshold values - $\alpha 2$, $\alpha 1$ and $\theta 2$ in order to identify whether the current value lies within one of three different ranges.

In particular, if the angle θ has a value less than $-\alpha 1$ (comparison phase 101 with negative result) the controller 10 acts on the card 9 to control (phase 104) a gradual decrease in the angular velocity so as to cause the gradual passage from the value ωmax to the value $\omega 0$ (phase 104, with return to phase 100). This result can be obtained from example with a look-up table which, for each value of θ provides a corresponding value of the function $\omega 2(\theta)$.

If the current value of θ lies between $-\alpha_1$ and $+\alpha 2$ (positive result of the comparison in phase 101, negative result in the comparison of phase 102) the controller 10 imposes on the card 9 the constant speed of rotation $\omega_0 = Vt/R$ (phase 105 with return to the reading phase 100).

If the current value of θ is greater than $\alpha 2$ and less than $\theta 2$ (positive result of the comparisons in phases 101

and 102, negative result of comparison phase 103) the controller 10 acts on the card 9 in such a way as gradually to increase the speed of the motor from $\omega 0$ to ωmax (phase 106, with subsequent return to the reading phase 100). In this case, too, it is possible to have recourse to a look-up table, in particular to that previously mentioned, exploiting the characteristics of symmetry of the functions $\omega 1(\theta)$ and $\omega 2(\theta)$.

Finally, if the comparison in phase 103 indicates that the current value of θ has exceeded value $\theta 2$, the PLC provides (phase 107) to step this current value of θ of the period value of the diagram of Figure 2, that is to say twice $\theta 2$, restarting the performance of the programme from input of the comparison at phase 101.

From the above it is apparent how the arrangement according to the invention lends itself to automatic adaptation in dependence on the geometry of the unit 1 and/or of the characteristics of the articles A and of the wrapping W (quantities Vt, $\alpha 1$, $\alpha 2$, R etc).

In particular, it is possible to consider pre-arranging the programmer 10 (for example by operating on the memory unit or units associated therewith) in such a way that, on variation of the operating characteristics (so-called "form change"), the programmer 10, upon receiving information (for example from a keyboard via simple action by an operator who need not even be particularly specialised) concerning the dimensions of the articles A, characteristics of the wrapping to be formed and (possibly) other parameters, selects the above-explained quantities totally automatically and, equally automatically, adapts its operation to the said characteristics.

CLAIMS

1. A method of controlling the operation of a rotary jaw closure unit for a packaging machine, the said unit including at least one active element which can, in use, interact with a wrapping in motion by an orbital trajectory movement about an axis; the said at least one active element having associated motor means controllable so as selectively to vary the speed of the said orbital movement, the method comprising:-

determining the interval of the orbital trajectory movement during which the said at least one active element is intended to interact with the said wrapping, and

controlling the said respective orbital trajectory movement, within the said interval at a constant velocity.

2. A method according to claim 1, applied to a closure unit, in which the said orbital trajectory movement of the said at least one active element takes place at least within the said interval at a given radius, and in which the movement of the said wrapping takes place at a given constant speed wherein, within the said interval, the angular velocity of the said orbital trajectory movement is controlled at a constant angular velocity given by Vt/R where Vt is the said given constant velocity and R is the said given radius.

3. A method according to claim 1 or claim 2, wherein, within intervals respectively upstream and downstream of the said interval during which the active element interacts with the wrapping, the speed of the said orbital trajectory movement is controlled to have a decreasing velocity and an increasing velocity respectively.

4. A method according to claim 3, wherein in the said upstream interval and in the said downstream interval the speed of the

said orbital movement is varied according to a substantially linear law.

5. A method according to any preceding claim, wherein the said orbital trajectory movement is controlled with a cyclic variation, each cycle of the said movement comprising an initial interval in which the speed of the said orbital trajectory movement decreases, an intermediate interval corresponding to the said interval of interaction with the said wrapping at constant velocity, and a terminal interval in which the said speed of the orbital trajectory movement increases.

6. A method according to any preceding claim, wherein said interaction interval with the wrapping is substantially symmetrical about a central reference position in which the said at least one active element is substantially orthogonal with respect to the wrapping.

7. A method according to any preceding claim, further comprising:-

associating with the said at least one active element at least one respective motor, and providing corresponding electronic means for selective control of the speed of rotation of the said at least one motor.

8. A method according to claim 7, further comprising:-

associating with the said at least one active element an angular detection element capable of providing to the said electronic means according to a general feedback arrangement, a signal indicative of the instantaneous position reached by the said at least one active element.

9. A packaging machine comprising a rotary jaw closure unit

which has an active element for interacting with a wrapping by moving in an orbital trajectory about an axis, motor means for driving the active element and control means for said motor means whereby the motor means drives the active element at a constant orbital velocity during an interval in which the active element interacts with said wrapping.

10. A method of controlling a packaging machine as herein described with reference to or as illustrated in the accompanying drawings.

11. A packaging machine as hereinbefore described with reference to or as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

-23-

Application number GB 9412934.3	

Relevant Technical Fields

(i) UK Cl (Ed.M) B5K, B8C (CU32, CW17)

(ii) Int Cl (Ed.5) B65B 9/00, 9/06, 51/26, 51/30

Search Examiner
S R SMITH

Date of completion of Search
1 AUGUST 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Documents considered relevant following a search in respect of Claims :-
1 TO 11

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2214128 A	(OMORI) see lines 2 to 15 of page 9 and line 3 to 17 of page 11	1 to 7, 9
X	GB 2179888 A	(GRACE) see lines 3 to 32 of page 2	1 to 9
X	GB 1332242	(SCHWEIZERISCHE) see line 125 of page 2 to line 6 of page 3	1 to 3, 5

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).